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Conscious Sedation

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Introduction

The dental profession has made great strides through the years in making dental treatment a more pleasant patient experience. Although access to dental care has continually improved in our population, a group of patients fails to seek dental treatment due to fear and anxiety. As the complexity of available treatment increases, the need has evolved to make these longer and more involved procedures more tolerable for patients. To accomplish this, various techniques are available ranging from psychological approaches and local anesthesia to pharmacological approaches, including sedation and general anesthesia. Sedation describes a depressed level of consciousness, which may vary from light to deep. At light levels, termed *conscious sedation*, the patient retains the ability to independently, and continuously maintain an airway and respond appropriately to verbal commands (1). The patient may have amnesia, and protective reflexes are normal or minimally altered. The choice of the most appropriate modality of sedation should be based on the training and experience of the dental practitioner; the nature, severity and duration of the procedure; and the physical and psychological status of the patient.

Traditional modes of conscious sedation in adults include oral, inhalation, and intravenous sedation. Indications for conscious sedation include anxiety, patient preference, spastic disorders of nerve and muscle, moderately difficult or long procedures, trismus, or persistent gagging. It is also indicated for patients with mild systemic disorders (such as controlled hypertension or asthma) to reduce stress and decrease the likelihood of exacerbating those conditions. Contraindications include severe systemic disease, pregnancy, severe psychiatric disorders, gross obesity, allergies to sedative drugs, acute narrow angle glaucoma (for benzodiazepines), uncooperative patients, patients on tranquilizers or antidepressants, unaccompanied patients, and insufficient dental resources or training (2).

Oral sedation is an enteral technique of administration in which the agent is absorbed through the GI tract. Oral administration of anxiolytic drugs generally results in a slightly to moderately sedated patient. Usually there are no changes in vital signs other than those related to relaxation from the anxious state. Oral sedation requires no specialized training beyond the doctoral level. Oral premedication, in appropriate doses, requires little monitoring of the patient and can be very efficacious. Advantages of this modality include patient acceptability, ease of administration, low cost, variable anterograde amnesia, and the presumption of safety. Limitations to the oral route include slow onset of action, patient compliance, lower ceiling of efficacy than parenteral route, inability to titrate dose based on patient response, prolonged duration of action, and difficulty administering reversal agent or emergency drugs in the absence of IV access (3). To maximize efficacy of oral sedative agents, they should be administered well in advance of need, and patients should avoid heavy meals before premedication.

A variety of drug classes, such as antihistamines and barbiturates, have historically been used for oral sedation. Due to their wide margin of safety, their efficacy, and selectivity for anxiety relief, the benzodiazepines have largely displaced the other drug classes (4). The benzodiazepines have anti-anxiety, sedative-hypnotic, anticonvulsant, and skeletal muscle relaxant properties. They exert their sedative effects by a generalized depression of the CNS. Drugs in this class include:

Diazepam (Valium)

Onset: Peak concentrations in 60-90 minutes; half-life=20-50 hrs (active metabolites).

Side Effects: Extensions of pharmacologic properties-drowsiness and ataxia; due to active metabolites produced as drug is metabolized resulting in residual sedation beyond the dental procedure; psychomotor impairment recovering within 2-4 hours.

Adult dosage: 5-15 mg approximately 1 hour prior to appointment

Cost: .38/tablet

Triazolam (Halcion)

Onset: Peak concentrations in 60-90 minutes; half-life=2.2 hrs (no active metabolites).

Side Effects: Postoperative psychomotor impairment, drowsiness, light-headedness; decreased inhibition, confusion, dream abnormalities, and hallucinations have been reported, but are rare.

Adult dosage: 0.25 mg at bedtime (night before appointment), followed by 0.25-0.50 mg 1 hour prior to appointment. Oral triazolam in doses of .25-.50 mg does not produce any adverse changesin respiration.

Cost: .30/tablet

Midazolam(Versed)

Onset: Peak concentrations in 30-60 minutes; onset usually within 30 minutes and extends up to 2 hours; half-life=1.5-2.5 hrs (no active metabolites).

Side effects: Same as for diazepam; recovery time thought to be less, but controversial.

Adult dosage: No consensus due to minimal data in literature on dose and monitoring needs.

After a recommended dose of an oral sedative and adequate local anesthesia, a persistently anxious or uncooperative pa-

tient should be reevaluated for use of parenteral sedation at future treatment appointments. Increasing the sedative dose or repeated readministration of local anesthesia to complete the planned procedure could result in excessive CNS depression with associated problems.

Inhalational sedation is a technique in which a gaseous or volatile agent is introduced into the pulmonary tree and whose primary route of absorption is through the pulmonary bed. Nitrous oxide is the only inhalation agent routinely used in dental practice. It requires minimal additional training beyond the doctoral level and is efficacious for the less anxious patient. Advantages include ease of use, rapid onset of action, ability to titrate to effect, analgesic and sedative properties, absence of drug interactions. Rapid and complete recovery permits the patient to be discharged without escort and with no restrictions on activities. Disadvantages include decreased efficacy for the moderately to severly anxious patient, unpredictable amnesia, reports of nausea and dizziness, sexual hallucinations, and concerns of chronic exposure of dental staff (2). A scavenging system, which attaches to the nasal mask, should be provided to reduce contamination of the surrounding air. Generally a mixture of 25% nitrous oxide with 75% oxygen is initially administered, followed by an interval of 2-3 minutes to observe the effect. The concentration of nitrous oxide can then be raised incrementally in steps of 5% at 2-3 minute intervals until the desired effect is obtained. At the end of the procedure, the patient should be placed on 100% oxygen for 3-5 minutes to decrease the potential for diffusion hypoxia (a condition that can render the patient briefly, but suddenly, unconcious). Recovery is normally complete within 15 minutes of discontinuing the nitrous oxide. As a rule, 70% of patients will need 30-40% nitrous oxide to achieve sedation (5). The amount of nitrous oxide should be reduced for longer procedures (>30 minutes). Contraindications to nitrous oxide sedation include pregnancy, the inability to tolerate a mask, blocked nasal passages, depressed respiratory system (COPD, tuberculosis, multiple sclerosis), congestive heart failure, and blocked eustacian tubes (rapid diffusion into air space can cause membrane rupture).

IV sedation is a parenteral technique in which the drug is introduced directly into the blood stream. The main advantages of the IV route are rapid onset of action, ability to titrate to effect, and to control the duration of sedation. Other advantages include higher levels of efficacy than oral or inhalation sedation, and IV access for emergency drugs or reversal agents if needed. Disadvantages include the need for venipuncture with its related possible complications of hematoma, venospasm, thrombosis, thrombophlebitis, and intraarterial puncture. Additionally, if there is an unknown allergy to the drug, onset of anaphylaxis is rapid. Postoperative recovery times from IV sedation are longer than parenteral or inhalation routes (3,6).

Midazolam has largely displaced IV diazepam because it allows for painless injection and much reduced risk of thrombophlebitis. In addition, it is 2-3 times more potent, has more rapid onset, more favorable amnestic qualities, and shorter recovery time than diazepam (7). Effects of midazolam in the systemic circulation are minimal but it does produce some respiratory depression, reduction in blood pressure, and increase in heart rate (8). Midazolam can be used as the sole agent for sedation or in conjunction with a narcotic (such as fentanyl). Supplemental doses can be given to maintain the desired level of sedation throughout the procedure. Midazolam is slowly injected just before the planned procedure until the desired endpoint (slurring speech, eyelid droop) is reached. The usual starting dose for a healthy adult is .035 mg/kg over 2-3 minutes (~2 - 2.5 mg for a standard size adult). Typically a 1mg/ml concentration is used for IV injection. After 2-3 minutes the patient should be assessed to determine if a supplemental dose is needed. These doses should be given every 2-3 minutes until the desired effect is achieved. Additional increments of 25% of the initial dose may be given to maintain the desired level of sedation (9). Maximum dose is 100 mcg/kg for conscious sedation, but dosages should be reduced for the elderly or if used in combination with narcotics (10).

Fentanyl is an opioid which, when combined with midazolam, has a synergistic effect. It is 100 times more potent than morphine, and produces analgesia at a dosage of 100 mcg. It is usually titrated in increments of 25-50 mcg during sedation procedures. It has a short duration of action due to its rapid redistribution. Although local anesthetics are used in IV sedation techniques, the clinical impression is that patients experience less discomfort during the administration of the local anesthetic and during the surgery, if narcotic analgesics are employed. The normal sequence is to sedate the patient prior to local anesthetic injections. The addition of narcotics to the sedation regimen can decrease the recovery time by decreasing the amount of benzodiazepine needed during the sedation (11). The combination of even low to moderate doses of benzodiazepines and opioids can create an increased risk for ventilatory depression. When a combination of drugs is used, there is clearly an increased requirement for vigilance on the part of the practitioner administering the drugs. It is important to remember that although equating dosage to body weight works well in establishing guidelines, it is critical for safe and reliable sedation that the dosage be slowly titrated against the patient's response. Regardless of the technique, oxygen supplementation via a nasal cannula is required for intravenous sedation.

History and examination

An accurate preoperative medical history and evaluation of heart rate, rhythm, blood pressure, and respiratory rate are essential for any sedation technique. The preoperative evaluation should also include a thorough review of systems, past anesthesia experience, any family history of complications related to anesthesia, tobacco and alcohol history, and current medication profile (12). The heart and lungs should be auscultated, and a brief examination of the airway is useful to note any possible obstructions. Laboratory tests should be ordered at the discretion of the clinician for specific concerns related to the medical history. A urinary pregnancy test must be ordered the day of the procedure for females of childbearing age if undergoing sedation with benzodiazepines. These agents readily cross the placental barrier and have been associated with fetal defects (2). Informed consent must be obtained for parenteral sedation and should include risks associated with the sedation, and alternatives to that form of treatment (12). Patients should receive preoperative instructions for IV sedation concerning proper attire (loose, comfortable), the need for an escort, and restriction of oral intake (4 hours prior for oral

sedation, 6 hours for IV sedation). An escort is required for both oral and IV sedation.

Monitoring physiological functions of the patient during sedative procedures will permit early recognition of potential problems, prompt intervention, and prevention of serious complications. The level and types of monitors necessary will vary with sedative techniques (13). Intraoperative monitoring is a necessity for parenteral sedation and is also indicated for oral and inhalational sedation if the procedure is lengthy, or if clinical judgement dictates. Patient monitoring is the key to safe maintenance of the sedative state. The type of monitoring necessary for safe treatment depends on the anticipated depth of CNS depression, the overall health of the patient, and the type of drugs administered. Intravenous sedation is more likely to depress vital functions, and therefore additional types of monitoring are necessary. Required monitors for IV sedation include a BP monitor, ECG, and pulse oximeter (1). Recommended monitors are a precordial stethoscope for monitoring respiratory and cardiac sounds, and a capnograph for monitoring expiratory patterns. Intraoperative documentation during IV sedation must include a time-based record of blood pressure, pulse, respiratory rate, verbal status, percent oxygen saturation, drugs and dosage administered, and oxygen flow rate (1). Intraoperative documentation with inhalation sedation should note the percent nitrous oxide used. The discharge criteria for conscious sedation should include an alert and oriented patient, stable vital signs that are within normal limits, ambulation with minimal assistance, absence of nausea or vomiting, absence of vertigo when standing, and the presence of an escort (13). The time of discharge should be recorded. Patients receiving oral or IV sedation should be given written and verbal postoperative instructions in the presence of the escort. The post-operative instructions should include recommendations for avoidance of sudden movements, the use of alcohol, engaging in any potentially hazardous activity such as operating machinery or driving for 24 hours, or being placed in a position of responsibility.

The personnel required for conscious sedation include the dental practitioner/anesthesia provider who is qualified to use the modality, and an assistant trained to monitor and record vital signs who is trained in BLS. The practitioner must be trained in, and capable of providing, BLS; training in ACLS is recommended for IV sedation techniques (14). Although intraoperative monitoring is usually not required with oral and nitrous oxide sedation, an assistant must be present for medicolegal reasons.

The safe use of any anesthetic technique depends on the availability of appropriate clinical resources to detect and respond to emergencies that may occur. Despite scrupulous attention to detail regarding technique and monitoring, intraoperative medical emergencies can arise. Possible complications include vomiting, seizures, anaphylaxis, and cardiorespiratory impairment possibly leading to cardiopulmonary arrest. The inadvertent production of unconsciousness is the leading cause of mortality and serious morbidity associated with sedation (13). The primary concern for the unconscious patient is inhibition of the protective reflexes which can lead to obstruction of the airway. Without exception, all patients having been rendered unconscious must be presumed to have obstructed airways and should be managed accordingly. Personnel should be trained in the recognition and management of emergencies associated with the administration of sedation. They should have immediate access to pharmacologic antagonists, appropriately sized equipment for establishing a patent airway, and machinery to provide positive pressure ventilation with oxygen (14). The reversal agent for the benzodiazepines is flumazenil (Romazicon) and is given IV in doses of 0.2 mg (maximum dose of 3 mg). Onset is within 1-2 minutes with a duration of action that is variable. Duration may not be as long as that of the benzodiazepines; therefore, re-sedation is a concern. For the opioids, the reversal agent that should be available is naloxone (Narcan), which is given IV/SC in doses of 0.4 mg, (maximum dose of 10 mg). Onset of action is within 2 minutes, and the duration of action is 30-60 minutes. An emergency kit should include necessary drugs and equipment to resuscitate a non-breathing and unconscious patient. Additionally, each member of the clinic should have a thorough knowledge of the clinic emergency plan so that all duties are accomplished without delay, and the plan should be rehearsed regularly.

Conclusions

Conscious sedation has a high level of patient acceptance and a remarkable safety record, however, there is no technique of drug administration which is entirely risk-free. The benefits to be gained through the use of any therapeutic agent must always be weighed against the potential risk to the patient. The risks associated with sedation can be dramatically reduced when the practitioner responsible for administering the drugs is properly trained, proper sedation techniques are used, adequate physical evaluation is performed, there is appropriate monitoring, and the staff is capable of managing complications.

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